

**Update  
COSEWIC Status Report**

on

**Mountain Plover**

*Charadrius montanus*

prepared for

**COMMITTEE ON THE STATUS OF ENDANGERED  
WILDLIFE IN CANADA**

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**DRAFT REVIEW:  
Submitted**

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# EXECUTIVE SUMMARY

## Mountain Plover *Charadrius montanus*

### Species information

The Mountain Plover is a medium-sized shorebird, about the size of a Killdeer (*C. vociferous*), but with longer legs and more erect posture. Upperparts are generally uniformly sandy-brown, underparts white, and breeding birds have a white forehead, black on top of the head, a distinctive black loreal stripe from the black bill to the eye, and a forecrown mottled black. The breast band present in many other plovers is absent in this species. There are no known subspecies

### Distribution

The Mountain Plover is a North American endemic. Its breeding range is in the western Great Plains, from extreme southeastern Alberta and possibly southwestern Saskatchewan south through Montana, Wyoming, Nebraska, Colorado, Kansas, New Mexico, Oklahoma and Texas with an isolated site in the Davis Mountains of west Texas and northern Mexico. Once a common breeder in short-grass prairie habitat of the Great Plains, the species is now absent from most of the eastern edge of its former range in South Dakota, Nebraska, Kansas and Oklahoma. Numbers have also dropped in the heart of its breeding range in Montana, Wyoming, Colorado and New Mexico. Mountain Plovers winter primarily from north-central California to the Mexican border, mainly in the Sacramento, San Joaquin and especially Imperial Valleys of California. The winter distribution outside California is poorly known; the lower Colorado River valley in Arizona supports a small population, and scattered flocks winter eastward to south-central and west Texas, and along the United States-Mexican border, more extensively on the Mexican side in Sonora, Tamaulipas and Chihuahua south to San Luis Potosi.

In Canada, the Mountain Plover is known only from extreme southeastern Alberta and southwestern Saskatchewan. The areas in which plovers have occurred most frequently in the last 30 years are: 1. Onefour, an 18,000 ha research station under lease from the provincial government to Agriculture and Agri-Food Canada. 2. Grasslands National Park, Saskatchewan. 3. The Wild Horse site, a ranch owned by David and Ralph Heydlauff. 4. Milk River Natural Area owned by the Alberta provincial government.

### Habitat

Historically, the range of Mountain Plover extended throughout the Great Plains and southwestern United States in short-grass prairie habitat dominated by herbivores such as prairie dogs (*Cynomys* spp.), bison (*Bison bison*) and pronghorns (*Antilocapra americana*). The Mountain Plover is a species of open, flat, xeric tablelands with sparse, low vegetation (usually less than 10 cm high) and with considerable bare ground. It also nests in prairie sites with a recent disturbance event such as lightning-strike fires. Originally described as an associate of arid, short-grass prairie dominated by blue grama

(*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*), more recently it is considered a disturbed-prairie or a semi-desert species requiring intensive grazing by large assemblages of herbivores.

In Canada, intense winter or spring grazing by cattle is considered especially important for the creation of suitable breeding habitat. The species has also used sage brush flats, with extensive areas of bare bentonite soils, and prairie dog towns.

## Biology

Mountain Plovers arrive on their breeding grounds in Canada in April, and nesting starts in May. In the United States, males show a fairly high rate of return to their breeding grounds, females less so. Males commonly reoccupy their former territories, which they defend against intrusion by other males. Eggs are laid in shallow depressions on the ground, often next to conspicuous objects such as cow manure pies. Clutch size is three, unusual for a shorebird. Also unusual is that the female first lays a clutch which the male incubates, and then lays a second clutch which she incubates. This reproductive strategy may be a result of low adult annual survival, which favours birds with annual increased reproductive output or a response to a fluctuating food supply on a yearly, seasonal and area-to-area basis, such that in years of ample food supply one parent is sufficient for successful rearing of the young.

Eggs are laid at intervals of up to six days, and incubation is 28-31 days, starting when the clutch is complete. Egg survival appears to be higher for males than for females, and chick survival higher for females than males. If the first nest or brood is lost before early June, adult may renest, generally within three km of first nesting attempt. The brood moves usually one to two km from the nest in the first two to three days. Only one brood is raised per adult per season, and young are cared for by just one parent. Fledging rates are quite low and range from 0.26 chicks/nesting attempt to about one chick/nesting attempt. The species appears to be loosely colonial, resulting in areas of apparently suitable habitat not being occupied.

Mean longevity is about two years; two individuals are known to have lived to at least 10 years of age. Overwinter survival rate appears high. Eggs and chicks have been reported as killed by a range of mammalian, avian and reptilian predators, and adults by foxes and falcons. The Mountain Plover appears to be a general opportunist of invertebrate taxa, feeding primarily on insects.

## Population sizes and trends

Current global population estimates are of 10,000 – 19,000, with a decreasing population trend. Trend analyses from Breeding Bird Surveys in the United States indicate a 2.85% annual survey-wide decline from 1966 to 2006 with declines occurring across all breeding habitats. There are a total of 36 records of Mountain Plovers in Canada. Twenty-two nests have been found in 12 years since the first nest was found in 1979. The maximum number of breeding individuals within one year has been 11, the maximum number of nests six, and in several years no plovers have been reported. Indeed, it may not breed every year.

## **Limiting factors and threats**

Before 1900 the Mountain Plover was an abundant and important gamebird in the United States. Populations suffered greatly in the 1800s and early 1900s owing to the uncontrolled trade in market hunting. Recent declines are attributed to the conversion of native grassland to cropland, agricultural practices, and the management of domestic livestock on both the breeding and wintering grounds. The decline of native herbivorous mammals, such as bison and prairie dogs, has led to detrimental changes in the remaining prairie ecosystems; indeed, in many of its breeding strongholds, Mountain Plovers are closely associated with prairie dog towns.

Pesticides have an unknown effect on Mountain Plover populations, but might be more critical on the wintering grounds in California. Weather extremes may play a significant role in the occurrence of Mountain Plovers in Canada; for example, fluctuations in precipitation can have adverse effects on the suitability of nesting habitat. Above average precipitation and resulting lush grass cover can render habitat unsuitable for nesting if existing grazing intensity is insufficient to maintain short vegetation and bare ground, and result in reduced horizontal visibility. Predation is not likely a major limiting factor, although the successful reintroduction of a known predator, the Swift Fox (*Vulpes velox*), could pose a risk on the plover's limited range in Canada.

## **Special significance of the species**

Mountain Plovers were first recorded nesting in Canada in 1979. Canada represents the northern edge of the breeding range of the Mountain Plover in North America, and indeed it may not breed every year within Canada. The species holds a certain mystique among Canadian birders such that when breeding individuals are located, on accessible land, then birders from across the country go to great lengths to see the species. It is likely not a bio-indicator as it occupies heavily grazed, disturbed, unvegetated or burnt prairie within its Canadian range.

## **Existing protection**

The Mountain Plover is currently designated as Endangered in Canada, it is a non-game species, and a migratory bird protected under the Migratory Birds Convention Act and the Species-at-Risk Act. It is ranked as a G-2 species by The Nature Conservancy. In Alberta and Saskatchewan, the species is ranked as S1B, Endangered. In the United States, the species is listed as Near-threatened.

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## SPECIES INFORMATION

### Name and classification

English name: Mountain Plover  
French name: Pluvier montagnard  
Scientific name: *Charadrius montanus*

Previous name: Rocky Mountain Plover (Knopf and Wunder 2006)

Classification: Class – Aves  
Order – Charadriiformes  
Suborder – Charadrii  
Family – Charadriidae  
Genus – *Charadrius*  
Species – *montanus*

There are no known subspecies.

The Mountain Plover was first collected in 1832 along the Sweetwater River of Wyoming by John Kirk Townsend and named by John James Audubon as the “Rocky Mountain Plover”, *Charadrius montanus* J. K. Townsend 1837. The Mountain Plover is a North American endemic; it has no close relatives in North America, and its closest affinities are evidently to the Caspian (*C. asiaticus*) and Oriental (*C. veredus*) plovers of the Old World, the three species perhaps constituting a superspecies (Hayman et al. 1986, AOU 1998).

### Morphological description

The Mountain Plover is a medium-sized shorebird, 21.0 to 23.5 cm in length and weighing from 90 to 110 g (Knopf 1996), about the size of a Killdeer (*C. vociferus*) but with longer legs and more erect posture. Upperparts are generally uniformly sandy-brown, extending along the sides of the neck and onto the chest. The breast band present in many other plovers is absent in this species; the forehead, throat, and breast are white, while the underwings are bright white (Knopf 1996). Breeding birds have black on top of the head and a distinctive black loreal stripe from the black bill to the eye. Non-breeding birds are similar to breeding plumage, with the loreal stripe and forecrown brown. Juveniles lack the black markings on the head, have a pale brown face with a paler brown supercilium, are buffier on their undersides, and have a back darker brown than adults with pale edgings giving a more scaled appearance. Chicks are whitish below and pale brown above with numerous black spots on the upper head, back and wings (Knopf and Wunder 2006).

The dorsal tip of the tail has a broad, black band, or patch, and the outer dorsal surface of the wings is also black (Knopf 1996, Sibley 2000). An additional field mark is a thin white line on the black-colored wing tip, evident in flight (Knopf 1996). The bill is black, iris auburn, leg colour a dull, light brown-yellow, foot colour dark brown, and claws black (Knopf 1996).

**Diagnostic Characteristics.** The combination of a black forecrown and white breast is a unique color pattern among North American plover species (Knopf 1996). The Mountain Plover's habitat is also distinctly different; it is misnamed as it lives on level land, and unlike most plovers, is usually not found near bodies of water or even on wet soil, preferring dry habitat with short grass and bare ground. An unwary species, it reportedly faces away from an observer and squats motionless in response to disturbance. This behavior results in the drably marked bird virtually disappearing and has fostered the nickname "Prairie Ghost" (Knopf and Wunder 2006). The species is generally silent (Graul 1974). Vocalizations include a rolling whistle used in advertising and courtship, anxiety calls, and a distinctive call used in agonistic and flocking situations, variously described as a low harsh *krrip* or *kip* (Knopf 1996, Wershler 2000).

## **Genetic description**

Phylogeny studies based on mtDNA from several species in the genus *Charadrius* places Mountain Plover within a clade which includes Two-banded (*C. falklandicus*), Collared (*C. collaris*) and Snowy (*C. alexandrius*) plovers in the Americas, plus Asiatic and Australasian species (Joseph et al. 1999). As mentioned earlier, the Mountain Plover has no close relatives in North America, and its closest affinities are to the Caspian and Oriental plovers of the Old World.

An examination of genetic variation at two mitochondrial regions for 20–30 individuals from each of four breeding sites in Montana and Colorado (the species' strongholds) revealed no evidence of significant population differentiation in the data from the control region or the ATPase 6/8 region (Oyler-McChance et al. 2005). Nested-clade analysis revealed no relationship between haplotype phylogeny and geography among the 47 control region haplotypes. In the ATPase 6/8 region, however, one of the two clades provided information suggesting that, historically, there had been continuous range expansion. Analyses of mismatch distributions and Tajima's D suggest that the Mountain Plover underwent a population expansion following the Pleistocene glacial period. To explain the lack of detectable genetic differentiation among populations, despite their geographic isolation and fidelity to breeding locations, Oyler-McChance et al. (2005) speculate that there is sufficient female-mediated gene flow to homogenize gene pools among populations. Such gene flow might ensue if pair bonds are formed in mixed flocks on wintering grounds rather than on the summer breeding grounds. Further research is continuing for possible differences among microsatellites (Knopf and Wunder 2006, St. John et al. 2007).

## **Designatable units**

Not applicable

## **DISTRIBUTION**

### **Global range**

The Mountain Plover breeds in the western Great Plains, from extreme southeastern Alberta and possibly southwestern Saskatchewan south through Montana, Wyoming, Nebraska, Colorado, Kansas, New Mexico, Oklahoma and Texas with an isolated site in the Davis Mountains of west Texas (Knopf 1996, Knopf and Rupert

1999), and northern Mexico (Desmond and Chavez Ramirez 2002) (Figure 1). However, such current distribution maps are misleading since habitat within this range is limited. Breeding strongholds are confined to small areas in east-central Montana (Bergeron et al. 1992), the Wyoming tablelands (Oakleaf et al. 1992), eastern Colorado where 60% of the entire continental population is believed to nest (Andrews and Righter 1992, Kuenning and Kinery 1998), north New Mexico (Hubbard 1978), and in the Oklahoma and Texas panhandles (Knopf and Wunder 2006). The periphery of the breeding range is defined by breeding records in Canada, Mexico, and the states of Utah, Nebraska and Kansas (Wershler and Wallis 1987, Ellison-Manning and White 2001, Fellows and Gress 1999, Gonzales Rojas et al. 2006). Breeding was first recorded in Mexico in Nuevo Leon in 2004 (Gonzales Rojas et al. 2006).

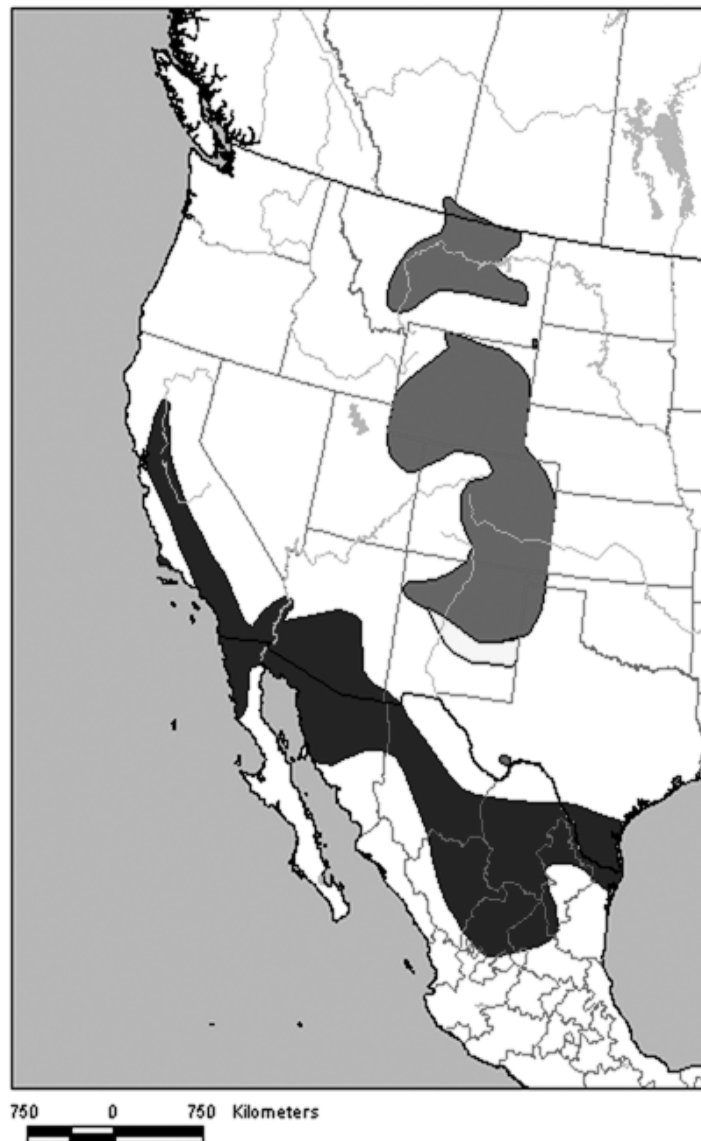


Figure 1. Breeding and wintering distribution of the Mountain Plover (from Ridgely et al. 2003).

Mountain Plovers winter primarily from north-central California to the Mexican border, mainly in the Sacramento, San Joaquin and Imperial valleys of California (about 85% of the population, Knopf and Rupert 1995, Wunder and Knopf 2003); in recent years the major part of the population now winters in the Imperial Valley (Wunder and Knopf 2003). These valleys historically supported large numbers of Tule elk (*Cervus elaphus*), pronghorns (*Antilocapra americana*) and kangaroo rats (*Dipodomys* spp.) that created a micro-landscape similar to the nesting grounds. The distribution outside of the California range is poorly known. The lower Colorado River valley in Arizona supports a small wintering population (Rosenberg et al. 1991), and scattered flocks also regularly winter eastward to south-central and west Texas (Fennell 2002), and along the United States-Mexican border, more extensively on the Mexican side in Sonora, Tamaulipas and Chihuahua, south to San Luis Potosi (Knopf and Wunder 2006). There are possible wintering populations in Baja California (Wilbur 1987).

Once a common breeder in short-grass prairie habitat of the Great Plains, the species is now absent from most of the eastern edge of its former range in South Dakota, Nebraska, Kansas and Oklahoma. Numbers have also dropped considerably in the heart of its breeding range in Montana, Wyoming, Colorado and New Mexico, and winter numbers have been continually declining in coastal areas of California (Small 1994) to very low levels, and also indeed are declining in the Sacramento and San Joaquin Valleys (Wunder and Knopf 2003).

### **Canadian range**

In Canada, the Mountain Plover has been recorded only in extreme southeastern Alberta and southwestern Saskatchewan.

### Historical Records

Coues (1874, 1878) has been cited extensively as providing evidence of the occurrence of Mountain Plovers in Canada in the 1870s (e.g., Wershler and Wallis 1987, Wershler 1989, 2000). The determination of the first occurrence of the Mountain Plover in Canada is not a mere curiosity, as such an occurrence would indicate if the species is one that occurred here prior to the 1870s but was then extirpated and is now regaining lost but original breeding areas, or if it is a relatively recent arrival from breeding grounds in Montana. It is therefore instructive to examine in detail the reports of Elliot Coues and the Northern Boundary Commission survey in Montana Territory (1874, 1878) (see Appendix 1).

Coues was attached to the United States Northern Boundary Commission with a mandate to explore the new territories south of the 49th parallel. An examination of Coues' original report reveals that his observations and collections of this species were in fact south of the border in Montana (Appendix 1; see Knowles and Knowles' 1998 summary of historical records of Mountain Plover in Montana). Coues' collection locations translate today to south of Grasslands National Park, Saskatchewan, to south of Wild Horse-Lost River, Alberta. Subsequent treatment of the occurrence of Mountain Plovers in Canada suggests that the species was unknown in Canada until the 1940s (Raine 1892, Taverner 1927, see below). Macoun and Macoun (1909), in their Catalogue of Canadian Birds, do not list it as a breeding species, stating (p. 211) "In June, 1895, the writer was on Frenchman river, Sask, for many miles and did not see a

trace of the bird so that lat. 49° must be close to its northern limit.” Mitchell (1924, in Waple 2005) describes it as hypothetical in Saskatchewan, and Bent (1929:269) states “(T)he species is unknown from Canada. During the international boundary survey, Dr. Coues found Mountain Plover on Frenchman Creek and obtained a specimen that is now in the British Museum .... the point of collection was probably well within the present State of Montana.” Taverner (1945:181) includes the Mountain Plover in his ‘Birds of Canada’ “because of specimens said to have been taken in 1897 on the International Boundary survey near Frenchman River, Saskatchewan; no such specimens exist. The confusion may stem from the fact that the Frenchman River originates in Saskatchewan and then flows south into Montana to the Missouri River. Rand (1948) does not mention any records from southeastern Alberta and found none during his visit to the Onefour area in July 1945. Finally, Williams (1946) traveling through this general area in 1923-1926 did not find them.

## Canadian Records

We are aware of 36 ‘element occurrences’ (*sensu* NatureServe 2008) of Mountain Plovers in Canada (Knapton et al. 2006, R. Knapton *pers. comm.*). This total includes 12 occurrences in 12 years of a total of 22 nests since the first nest was found in 1979, and seven additional occurrences of pairs of plovers in the breeding season that probably represent breeding attempts but no nest was located that year at that site. Most records fall into two distinct areas, the Lost River – Wild Horse area of extreme southeast Alberta, and the Val Marie - Grasslands National Park area in southwest Saskatchewan (Figure 2).

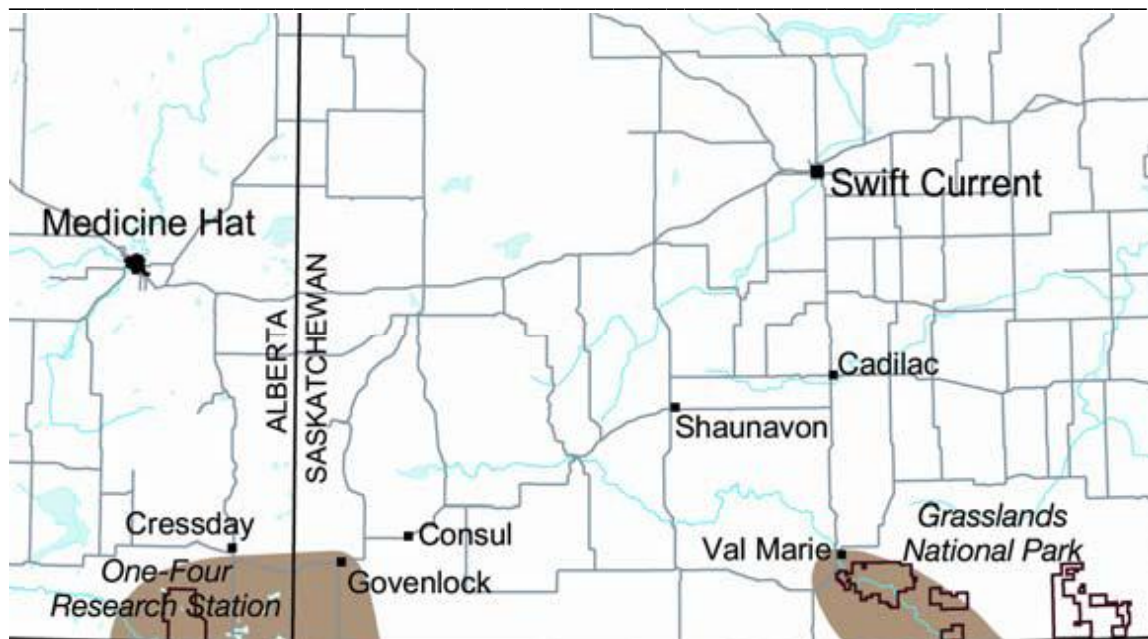


Figure 2. Breeding range of the Mountain Plover in Canada (from Environment Canada 2006)

The first Canadian sight record was in June 1939 “two miles north of the village of Bracken” and 22 km north of the international border in Saskatchewan (Soper 1939). Currently this area is under intense cultivation and is unlikely to be suitable as nesting

habitat (R. Knapton, *pers. obs.* 2005). In June 1941 Soper collected two males from four plovers on short-grass prairie about eight km north of the International Boundary north-northeast of Wild Horse, Alberta; their behaviour indicated breeding (Soper 1941, p. 137). The area was described as flat to gently rolling, with short sparse grass, interspersed with small bare areas of clay. The significance of this particular record is that this location has produced numerous sightings of Mountain Plovers since 1941.

Following Soper's observations in 1941, there followed a gap of over 20 years before the next record in Alberta, a sight observation of two birds in June 1966 at Elkwater in the Cypress Hills, a habitat apparently unsuitable as a breeding location (Wallis and Wershler 1981).

Lost River – Onefour, Alberta. In September 1977, five Mountain Plovers were located northeast of Onefour, a family party of two adults plus three juveniles (Wallis and Wershler 1981). The first nesting records for Canada occurred in 1979 when two nests were located in the Lost River area and subsequently three adults with nine newly hatched young were observed in mid-June (Wallis and Loewen 1980). Thereafter, searches in the Lost River-Onefour area in the following years produced evidence of nesting in 1980, 1981, 1985 and 1988 with a maximum of six nests with 3 eggs each in 1981, and the presence of birds in 1982 and 1983 (Wershler and Wallis 1987). After a gap of 12 years the next record was in April 2001 (Wershler and Wallis 2001), followed by another gap of four years when adults and a nest were located in June 2005 (Knapton et al. 2006). No plovers were reported at Onefour in 2006 through 2008, despite considerable search effort (see below).

Wild Horse, Alberta. The Wild Horse area is located in extreme south-east Alberta in Townships 1 and 2, Range 1 and 2, about 20 km southeast of the Lost River, and the area where Soper collected his two specimens in 1941. There have been several sightings of Mountain Plovers in this area following a report in May 1986 (Wershler and Wallis 1987). Evidence of nesting was obtained in 1990, 1994, 1999, 2006 and 2007 with three nests located during both 2006 and 2007, and plovers were present in 2001, 2005 and 2008 (Wershler 2000, Wershler and Wallis 2001, Hannah 2003, Knapton et al. 2006, D. Heydlauf *pers.comm.*, G. Holroyd, H. Trefry & R. Knapton, *pers. obs.*).

Milk River, Alberta. There is a passing reference to two Mountain Plovers in July 1971, a few kilometers north of the international border about 30 km west of Wild Horse in Salt and Salt (1976). Non-breeding adults occurred along the Milk River in May 2002 (Hannah 2003). In May 2008, Cliff Wallis and Cleve Wershler found a territorial, displaying, calling pair on the west side of the Milk River Canyon on burnt land in the Milk River Natural Area (C. Wallis, *pers. comm.*). C. Wershler writes ... "this observation confirms the importance of burning as a management tool for the creation and maintenance of Mountain Plover breeding habitat in Alberta" (C. Wershler, *pers. comm.*).

Other Alberta Records. A single bird was reported on April 20, 2002, in slightly rolling prairie with grass one to five cm as ground cover south of CFB Suffield, about 4 km north of Hwy 1 (BSOD, Hannah 2003).

Grasslands National Park, Saskatchewan. In Grasslands National Park, eight plovers were reported in September 1977 (Peart and Woods 1980), then a family group of two adults and three fledglings ("almost flying young") in 1987 (Gollop 1987a), the only known breeding record for Saskatchewan (Gollop 1987b). Subsequent records are an

adult in June 1991 (Wayne Harris, in Wershler and Wallis 2001), and a single adult in May 1999 (Knapton et al. 2006). All these records have been associated with prairie dog colonies. No other plovers have been recorded at these colonies since 1999 despite considerable search effort (see below).

Other Summer Saskatchewan Records. Two records: an “undated sighting by John Shadick about 1959, south of Govenlock” (Houston et al. 1981) and an adult in the Breed Creek area, southwest of Mankota, in 1991 (Koes and Taylor 1991).

Extent of Canadian Range. Wershler (2000) calculated that, based solely on information from Alberta locations since 1979, the extent of occurrence in Canada was estimated at less than 20 km<sup>2</sup> and the present area of occupancy less than five km<sup>2</sup>. He further estimated that the potential area of occurrence in Alberta, given appropriate management conditions, at less than 150 km<sup>2</sup>.

*Manitoba, Ontario, Quebec, Nova Scotia, New Brunswick and Prince Edward Island, British Columbia, Newfoundland, Yukon, Nunavut and Northwest Territories* – There are no known records of Mountain Plovers from these provinces and territories.

## HABITAT

### Habitat requirements

Historically, the range of the Mountain Plover extended throughout the Great Plains and southwestern United States in short-grass prairie habitat dominated by herbivores such as prairie dogs (*Cynomys* spp.), bison (*Bison bison*), and pronghorn antelope. Much of the eastern part of the historic breeding range no longer support Mountain Plover with extirpations in Kansas, Nebraska, South Dakota, and North Dakota (Knopf 1996). Changes in agricultural practices, human expansion into breeding habitat and the elimination of prairie dog colonies has led to a 60% decline in numbers over three decades (Leachman and Osmundson 1990). Similarly, while Mountain Plovers once wintered throughout the southwestern United States, they are now mainly restricted to the valleys of California where agricultural land use practices may also have a negative impact on populations.

The Mountain Plover is a species of open, flat, xeric tablelands with sparse, low vegetation (usually less than 10 cm high) and bare ground, variables that appear to be essential habitat features for occupancy (Knopf and Wunder 2006). Its elevational range extends from 640 m in eastern Montana to 3250 m in south-central Colorado (Knopf and Wunder 2006). The plover also nests in prairie sites with a recent disturbance event such as lightning-strike fires. It was originally described as an associate of arid, short-grass prairie (Graul and Webster 1976) dominated by blue grama (*Bouteloua gracilis*) and buffalo grass with scattered clumps of cacti and forbs. However, without some intensive grazing by large assemblages of herbivores, the bird does not use the prairie. In fact, the tendency for these plovers to select native habitats with substantial bare ground, coupled with former cohabitation with large herds of bison, pronghorn, elk and prairie dogs, indicate that it is a disturbed prairie or semi-desert species rather than a short-grass associate (Knopf and Miller 1994, Plumb et al. 2005b).

In western Wyoming the species is a member of shrub-steppe communities (Beauvais and Smith 2003) where patches of low and sparse vegetation are largely due to poor soil quality, chronically low precipitation and constant wind scour. These factors are relatively static or frequent in time and space, leading to persistent bare patches. Thus, high quality habitat for Mountain Plovers may actually be highly stable in space and time (Beauvais and Smith 2003).

Knopf and Miller (1994) suggest 30% bare ground as a minimum habitat requirement in Colorado, and Parrish et al. (1993) reported 72% bare ground at nest sites in Wyoming. Nests are often near cow manure pies (Graul 1975, Knopf and Miller 1994). Where taller grasses dominate a landscape, the plovers are restricted to areas of excessive grazing; indeed, in Montana at many locations, breeding pairs are associated with prairie dogs and appear to be totally restricted to such areas and absent from landscapes of taller grasses and shrubs (Olson-Edge and Edge 1987). Prairie dogs create unique patches of habitat ideal for Mountain Plovers, promoting short grasses such as buffalo grass and grama grasses, and their digging creates areas of bare soil important for plover nesting. Furthermore, prairie dog towns attract many species of insects and provide greater horizontal visibility (Olson and Edge 1985). Mountain Plovers will use towns as small as 3 ha (Knowles et al. 1982), but on average the towns are much larger, about 50 ha (Knowles and Knowles 1984, Olson-Edge and Edge 1987). Dinsmore et al. (2003, 2005) and Augustine et al. (2008) have shown that Mountain Plover breeding populations closely track annual changes in the area occupied by Black-tailed Prairie Dogs, with both plovers and prairie dogs recovering from outbreaks of sylvatic plague in the mid 1990s.

Winter or spring grazing by cattle appears to be especially important for the creation of suitable breeding habitat in Alberta (Wershler and Wallis 1987, Wershler 1990) and Montana (Knowles and Knowles 1997). The occurrence of Mountain Plovers on sage brush flats with extensive areas of bare bentonite soils in Canada is mirrored also across central and western Wyoming and Montana, and also in South Park, Park Co., Colorado (F. Knopf, *pers. comm.*). These observations further support the idea that the species is a disturbed-desert species rather than a strict associate of the short-grass prairie.

Shackford and Leslie (2000) located Mountain Plovers on cultivated land in the Oklahoma panhandle, Kansas, Colorado, Wyoming, and Nebraska. However, Mountain Plovers were absent on cultivated fields north of southeastern Wyoming (Laramie County), and occupancy of cultivated land is apparently unknown in Montana and in Canada. Finally, the wintering habitat of the Mountain Plover is similar to that used in the summer. Flocks can be found on coastal prairies, alkaline flats, ploughed fields and cropland.

## **Habitat trends**

The removal of primary native grazers – prairie-dogs, bison and pronghorns – has historically altered the native grasslands and in part led to declines in many endemic grassland species (Knopf 1994). In Montana, and likely elsewhere, Mountain Plover populations certainly declined following elimination of the bison, and are still directly related to surface coverage of active black-tailed prairie-dog towns (Dinsmore et al. 2005). Extensive turning of native sod and planting of winter wheat on marginally arable

lands further preclude the plovers from nesting throughout much of the western Great Plains. Also, many farmers have sown taller grasses in native prairie, and tall vegetation precludes nesting by this species which depends on vision to detect predators (Knopf and Wunder 2006).

Furthermore, farms on the western Great Plains have become larger, and some new crops have become economically popular. Many farmers now plant extensive areas to sunflowers and millet for vegetable oils and the commercial bird-seed market. Millet is also planted as a hay crop. Fields for these grains remain fallow until early May, after most Mountain Plovers have started nesting, and many nests are destroyed by farm equipment when fields are planted in May (Dreitz et al. 2005).

### **Habitat protection/ownership**

In Canada, the areas in which Mountain Plovers have occurred most frequently in the last 30 years are the following. 1. Onefour, an 18,000 ha research station under long-term lease from the Alberta provincial government to Agriculture and Agri-Food Canada, Lethbridge Research Centre. 2. Grasslands National Park owned by the federal Parks Canada Agency. 3. The Wild Horse site, a ranch owned by David and Ralph Heydlauff partly comprised of provincially leased land. 4. Milk River Natural Area owned by the Alberta provincial government.

Mountain Plovers nest in several areas under some degree of protection in the United States. In Montana, the Charles M. Russell National Wildlife Refuge where an IUCN, the International Union for Conservation of Nature, conservation action is underway supports fairly high densities of nesting plovers. In Phillips County, Montana, nearly all plovers are found on active prairie dog colonies that also are grazed by cattle (Dinsmore et al. 2003). Prairie dog towns occur on the Fort Belknap Indian Reservation, Bureau of Land Management (BLM), State school lands, and private lands. Mountain Plovers at the Fort Belknap Indian Reservation increased from 0 to 20 from 1993 to 1998 and to possibly 100 by 2002 following an increase in Black-tailed Prairie Dogs and the introduction of bison grazing (Knowles and Knowles 2001; Dinsmore et al. 2003). Elsewhere in Montana, plovers breed on land administered by the BLM in Valley County (Little Beaver Creek) (Knowles and Knowles 1998).

Since the conservation of the Mountain Plover depends on the protection of suitable nesting habitat, the conservation of prairie dogs, and the protection of known nesting sites, efforts to carry out these conservation measures are underway in a number of areas, such as the Pawnee National Grassland in Colorado, where a Mountain Plover management strategy has been implemented (Dinsmore 2003, del Hoyo et al. 1996), and Comanche National Grassland in Colorado (Svingen and Giesen 1999). In addition, the Mountain Plover and the Black-tailed Prairie Dog have been proposed for listing under the Federal Endangered Species Act (Birdlife International 2008), which would offer more protection to these declining species. The release of Black-footed Ferret in Mexico is also helping with prairie dog colony protection (Knopf and Wunder 2006).

## **BIOLOGY**

### **Life cycle and reproduction**

*Arrival on Breeding Grounds.* Mountain Plovers arrive on their breeding grounds in small flocks in the second half of March in Colorado, and in April in Montana and Canada (Knopf and Rupert 1996). Nesting starts in April in the United States, and probably in May in Canada.

*Duration and Maintenance of Pair Bond.* Pair bonds are maintained for the breeding season only, as 83% of males but only 40% of females return to the same territory in subsequent years. At least some females visit territories of many males before selecting a mate each year (Knopf and Wunder 2006). Observations of marked pairs (Graul 1973) indicate that the pair bond is poorly developed, and except during copulations adults remain 6-15 m apart and do not mutually defend the territory (Graul 1975).

*Territoriality.* Males commonly reoccupy their former territories, which they defend against intrusion by other males (Graul 1973). One of two nesting plovers that were banded near Wild Horse in 2007 was resighted in the same area, but the sex of the plover is unknown (G. Holroyd, *pers. obs.*). Territories in Colorado were about 16 ha, although much overlap occurred at the boundaries, and foraging is evidently frequent outside territory boundaries (Graul 1973). Mountain Plovers are only territorial during the breeding season.

*Nesting.* Egg laying starts in mid-April and continues through mid-June in northern Colorado (Graul 1975). During courtship, several nest scrapes are made before one is eventually chosen for a nest. The nest is a shallow depression in the ground lined with a small amount of vegetation, often next to conspicuous objects such as cow manure pies.

Eggs are well-camouflaged, dark olive with black markings (Baicich and Harrison 1997). The unusual clutch-size (three as opposed to four, standard for northern and temperate-zone shorebirds) is a function of a rapid multi-clutch mating system (Graul 1973), in which the female leaves the male to incubate the eggs in a first clutch while she lays a second clutch which she incubates herself. This reproductive strategy may be a result of low adult annual survival, which favours birds with annual increased reproductive output (Dinsmore et al. 2003), or a response to a fluctuating food supply on a yearly, seasonal and area-to-area basis, such that in years of ample food supply one parent is sufficient for successful rearing of young (Graul 1973).

Eggs are laid at intervals of up to six days, and incubation is 28-31 days, starting when the clutch is complete. Incubation is performed by each parent alone. Gradually the nest scrape is built up with rootlets and grass, as the incubating bird adds vegetation and other material to the nest site (Knopf and Wunder 2006). Dinsmore and Knopf (2005) found that nest survival was higher for males than for females (0.33 for females, 0.49 for males), and that chicks tended by females had higher survival rates than those tended by males. These data suggest a trade-off for adult plovers between the egg and chick phases of reproduction. This unique breeding system is a means of spreading risk, and thus increasing the chance that at least one brood of the pair will survive in a highly unpredictable landscape subject to major drought cycles, intensive grazing, and fluctuating prey and predator populations (Dinsmore and Knopf 2005).

Only one brood is raised per adult per season (Graul 1973). If the first nest or brood is lost before early June, an adult may renest, generally within 3km of first nesting attempt. With renesting, each pair can potentially make up to four attempts per year to

raise a brood successfully (Knopf and Wunder 2006). Parents quickly remove eggshells from the nest as chicks hatch, and the brood moves usually one to two km from the nest in the first two to three days (Knopf and Rupert 1996). Young are cared for by just one parent. Fledging rates are quite low and range from 0.26 chicks/nesting attempt to about one chick/nesting attempt (Knopf 1996), with success varying among years. Drought conditions lead to low fledging rates, probably because predation rates are higher when food is in short supply (Knopf 1996). In Colorado, the minimum habitat size for brood-rearing was estimated at 28 ha (Knopf and Rupert 1996) but other studies indicate much larger requirements (46 ha in rangeland, 131 ha in agricultural fields, and 243 ha in prairie dog towns, Dreitz et al. 2005).

The species appears to be loosely colonial. Solitary nests are often located in isolated patches of habitat, but many nests occur in localized areas, suggesting a loose colony or at least a passive aggregation of birds (Knopf 1994, 1996). Nests are on average 140 m apart. This clumped distribution results in areas of apparently suitable habitat not being occupied (e.g., 70% of shrub-steppe area in Utah, Manning and White 2001, 65% of potentially suitable habitat at South Park, Colorado, Wunder and Knopf 2003).

Nesting sites typically have vegetation less than 10 cm in height, 30 – 50% bare ground and lichen, and extensive areas (0.5 – 1 km diameter) of nearly level (less than five % slope) terrain (Knowles and Knowles 1998). These open sites allow detection of predators, especially avian predators such as Prairie Falcons (*Falco mexicanus*) (Knopf 1996). In Canada, Mountain Plovers have nested in heavily grazed or recently burned areas of native mixed grassland and sagebrush/bentonite flats. One nest was found in a field of exotic Russian wild rye and native plant species that had been lightly cultivated (Wershler 2000).

In Canada, Black-tailed Prairie Dogs are found only in and around Grasslands National Park. Richardson's Ground Squirrels (*Spermophilus richardsonii*) occur within the breeding range of the Mountain Plover in Canada, but the extent to which they create and maintain nesting habitat is not known (Wershler 2000). Their burrowing activities could increase the amount of bare ground, a variable which is important in habitat occupancy by Mountain Plovers. The report by Knowles and Knowles (1998) of a pair of Mountain Plovers in Toole County nesting in an intensively cattle-grazed grassland site occupied by Richardson's Ground Squirrels suggests that such habitat will be occupied on occasion but no such association has been noted in Canada.

*Annual and Lifetime Reproductive Success.* Annual reproductive success on the Pawnee National Grassland, Colorado, was highly variable, from 26% (Knopf and Rupert 1996) to 65% (Graul 1975). The average number of eggs hatching in successful nests varied from 2.1 (McCaffery et al. 1984) to 2.7 (Graul 1975) per nest. There is no information on lifetime reproductive success.

*Life Span and Survivorship.* Annual survival rate was calculated as 0.46–0.49 for juveniles and 0.68 for adults in Montana (Dinsmore et al. 2003). Mean longevity has been calculated as  $1.9 \pm 0.2$  yr., with longevity records of at least 10 years for both a male and a female (Knopf and Wunder 2006). Overwinter survival rate appears high (0.95 from November to March, Knopf and Rupert 1995).

*Disease and Body Parasites.* No information.

## Predation

Eggs are lost primarily to predation and hail damage, while chick mortality is primarily the result of predation (Knopf and Wunder 2006).

Eggs and chicks have been reported as killed by Thirteen-lined (S. *tridecemlineatus*) and Wyoming ground squirrels (S. *elegans*), Swift Fox (*Vulpes velox*) and Coyote (*Canis latrans*). Chicks have also been taken by Swainson's Hawk (*Buteo swainsonii*), Prairie Falcon, Burrowing Owl (*Athene cunicularia*), American Kestrel (*Falco sparverius*) and Loggerhead Shrike (*Lanius ludovicianus*) (Graul 1973, 1975, Miller and Knopf 1993, Knopf and Rupert 1996, Knopf and Wunder 2006). Young chicks have been killed by red ants (*Formica* sp.) and burying beetle (*Nicrophorus* sp.) in the nest cup. Ravens (*Corvus corax*) have watched biologists at a nest then taken eggs as soon as investigators have left if the nest was marked. The Bullsnake (*Pituophis melanoleucus*) was strongly suspected of taking eggs from nests covered by a mammal-proof predator enclosure.

Six predations have been reported on adults: two birds killed on the wintering grounds by kit foxes (*V. macrotis*; Knopf and Rupert 1995), three at or near nests by raptors, and one radio-transmitter from adult plover recovered at a Prairie Falcon nest (Knopf and Wunder 2006). Prairie Falcons fly low and surprise prey by coming over ridges at fast speeds to make captures. Mountain Plovers regularly turn their heads sideways to scan the sky for raptors (Graul 1975, McCaffery et al. 1984) and prefer open, flat habitat, avoiding areas below ridges; they can probably fly faster than a pursuing falcon if the element of surprise is removed. Swift Foxes may limit Mountain Plover productivity in Colorado (Knopf and Rupert 1996), and this fox plus badgers (*Taxidea taxus*) likely have increased in numbers with the banning of predator-poisoning programs in the 1960s and 1970s. The Swift Fox is currently extirpated from more northerly breeding areas, but the successful re-introduction efforts underway in Montana and Canada may have negative consequences for plovers. From 1992–1994, eggs in only one nest on Pawnee National Grassland were lost because a cow stepped on them (Knopf and Rupert 1996). Mortality to eggs and chicks has been attributed to overheating when exposed to prolonged sun, hailstorms and flooding (Graul 1973, 1975, Knopf and Wunder 2006). Cold, wet weather during breeding limits populations and reproductive success.

## Physiology

There is no information on nutrition, energetics, metabolism, or temperature regulation. Individual birds often roost in depressions such as ungulate hoof prints and plough furrows which may provide a microhabitat that improves thermoregulation and likely helps avoid detection by nocturnal predators (Knopf and Rupert 1995). All water requirements are apparently obtained from food items; as in many species that inhabit arid environments, the species can thrive without drinking free-standing water. Mountain Plovers have been observed twice drinking opportunistically from puddles following a rain shower (Knopf and Wunder 2006).

## Food

The Mountain Plover appears to be a general opportunist of invertebrate taxa, primarily insects (Knopf 1996, 1998). The type of prey consumed changes through the season with beetles most common from late spring to midsummer and grasshoppers and ants eaten in greater quantities in late summer. Studies in Colorado showed invertebrates from 90 different taxa, with beetles (Coleoptera; 60%), grasshoppers and crickets (Orthoptera, 24.5%), and ants (Hymenoptera; 6.6%) the most important prey items (Baldwin 1971). The genus *Eleodes* (darkling beetles) composed 22% of diet.

On its wintering grounds, plovers have been regularly observed capturing and eating grasshoppers, crickets and beetles (Storer 1941), but wintering birds have also taken centipedes (*Chilopoda* sp.) and scorpions (Scorpionida). Stomach analyses of 39 birds collected in California (Knopf 1998) revealed that Hymenoptera and Coleoptera dominated diet on the Carrizo Plain, Lepidoptera and Hymenoptera on the Pixley National Wildlife Refuge, and Orthoptera and Coleoptera in the Imperial Valley.

## **Dispersal/migration**

The Mountain Plover, like many shorebirds, is a strong flyer and may cover several hundred kilometres a day during migration. Around late July, plovers leave their breeding range for a period of post-breeding wandering around the Great Plains. Little is known about their movements at this time, although they are regularly seen around Walsh, Colorado, and on sod farms in central New Mexico. By early November, most move south or west to wintering grounds. Migrations from breeding grounds in Colorado and Wyoming are likely more east-west than north-south for those birds wintering in California. Populations may be semi-migratory in New Mexico where birds are seen in midwinter (Ligon 1961), and non-migratory in Davis Mountains, Texas, and Nuevo Leon, Mexico.

In California, winter migrants generally arrive in the north by mid-September and in the south by mid-October (Small 1994). They arrive along the Lower Colorado River and in Texas mid-October (Fennell 2002, Rosenberg et al. 1991), and have been recorded November through March in Mexico (Howell and Webb 1995). There are extralimital records from Massachusetts, Virginia, Washington and Indiana (Knopf and Wunder 2006).

On the wintering grounds in California, flock size increases in mid-February (Knopf and Rupert 1995) and by early March, large flocks begin circling foraging areas in extended flights for several days before ultimate departure, which appears to be mostly at night (Knopf and Wunder 2006). Most birds depart their wintering grounds in early March (Small 1994, Knopf and Rupert 1995). Spring migration proceeds relatively quickly, with earliest observed arrivals to breeding grounds by mid-March in the earlier warming portions of the range (New Mexico and eastern Colorado) and by mid-April in regions that are later to warm (Montana, central Colorado). There is no information on altitude or speed of migration, and the species has not been reported migrating with other species. There is no information at all on where Canadian populations winter.

## **Interspecific interactions**

Mountain Plovers have been recorded as charging and chasing Thirteen-lined and Wyoming Ground-squirrels (both predators), McCown's Longspurs (*Calcarius*

*mccownii*), Horned Larks (*Eremophila alpestris*), pronghorns, and livestock in the vicinity of the nest, using the Tail-down Rush Display (Graul 1975). Occasionally a bird will Flutter Jump (flap wings and jump) in the face of a cow to distract it (Graul 1973a, McCaffery et al. 1984).

Past reports indicate a degree of interspecific territoriality between Killdeer and Mountain Plovers, but this appears to be unlikely; a Mountain Plover has been seen to charge a Killdeer on one occasion on the breeding grounds (Knopf and Wunder 2006). Although interspecific nest parasitism among shorebirds is very rare, Mountain Plover nests have been found parasitized by Killdeer (Jojola-Everium and Giesen 2000).

### **Adaptability**

See under **Threats**. In the southern part of the breeding range, nests in cultivated fields demonstrate a certain degree of adaptability (Dreitz et al. 2005). Mountain Plovers are not known to use cultivated land in Montana, and likely do not in Alberta and Saskatchewan.

## **POPULATION SIZES AND TRENDS**

### **Search effort in Canada**

Wershler and Wallis (2001) flew aerial surveys in May 2001 across southeastern Alberta and southwestern Saskatchewan, followed by subsequent ground truthing, to identify sites potentially suitable for occupancy by Mountain Plovers. A hundred sites were identified: of these, 30 were assessed as having high and 31 limited potential for Mountain Plover nesting habitat. Most (73%) of the high potential sites were located in upland grasslands in southeastern Alberta and immediately adjacent Saskatchewan, with the remaining 27% associated with Black-tailed Prairie Dog colonies in Grasslands National Park. Intervening areas were considered unsuitable owing to intense cultivation. High potential habitats included well-drained level grasslands, more localized areas of level, well-drained grassland within grassland-sagebrush and lower-lying solonchic soil areas, and prairie dog colonies. Of 17 sites with high suitability and high potential, four were in prairie dog colonies in the Val Marie area, and 13 were in the Lost River – Milk River and Wild Horse – Govenlock regions. Those high potential sites with limited suitability sites lacked intensive grazing, the major factor restricting suitability.

Canadian Wildlife Service biologists Geoffrey Holroyd and Helen Trefry with co-workers have conducted Burrowing Owl research for about 100 days, amounting to over 1500 person-hours, between May and July 2002-2008 in habitats of varying potential as Mountain Plover habitat at Onefour and surrounding area. In addition, 280 point counts for owls and other bird species were conducted from 2002-2005, and between four and eight days per year were devoted to searching for plovers from 2005 - 2008 (Knapton et al. 2006; G. Holroyd *pers. comm.*). Mountain Plovers were encountered each year between 2005 and 2008 (see above). Furthermore, the biologists spent over 150 days, amounting to over 2000 person-hours in high potential habitat (prairie dog colonies) in Grasslands National Park and surrounding areas from 1998 to 2008 and observed only one Mountain Plover (see above). Their 11 years of surveys included 75% of prairie dog towns in and around Grasslands National Park. The total area of prairie dog towns in

Grasslands National Park and vicinity was calculated to be 965 ha in 2004 (Fargey et al. 2005).

Prairie Farm Rehabilitation Administration (PFRA) pastures have also been surveyed as part of searches for Burrowing Owls by Canadian Wildlife Service (CWS) staff and contractors. The following pastures have been searched: in Swift Current District: Auverge-Wise Creek, Beaver Valley, Masfield, Val Marie, and Lone Tree pastures; and in Maple Creek District: Battle Creek, Govenlock, Nashlyn, Reno #1 and Reno #2. Most of these pastures were visited each year from 2002 to 2005. The greatest effort was in 2002, 2003 and 2005 with 16 days of dedicated searches for Mountain Plovers (Knapton et al. 2006). No Mountain Plovers were detected. Lastly, in the 1990s, the area between the Sweetgrass Hills, Montana, and the Milk River in Alberta was searched, with no plovers being located (S. Brechtel, *in* Knowles and Knowles 1998).

## **Abundance**

Initial estimates placed the total population as low as 5600 (Morrison 1994, Rose and Scott 1997). This population estimate was adjusted upwards by Knopf (1996) to 8000–10 000 birds based on the numbers found during a winter count in California in 1994 (3346, which was then doubled) plus estimated wintering populations in Texas and Mexico (1000–3000). Using more refined field methodology for population estimates in Wyoming, Plumb et al. (2005a) revised the continental population estimate to 11000 to 14000 birds. The species' range just extends into Canada. Morrison (2001) and Morrison et al. (2001) put a population estimate of 10 pairs for Canada, and Wershler (2000), whilst acknowledging that scientific survey data were lacking, states that “during the last two decades there have probably been fewer than 50 adult Mountain Plovers in Canada”.

Current population estimates are of 10,000 – 19,000, with a decreasing population trend and a range estimate (breeding/resident) of 758, 000 km<sup>2</sup> (Knopf and Wunder 2006). Estimated populations are as follows; 1200 individuals in east-central Montana, 3400 in Wyoming, 8600 in eastern Colorado, 2300 in Park County, Colorado, plus much smaller numbers in other states and in Canada.

## **Fluctuations and Trends**

Mountain Plovers have been recorded on Breeding Bird Surveys (BBS) only in the United States, where they have declined at a rate of 3.7% per year from 1966 to 1993 (Knopf 1994, 1996), translating into a two-thirds reduction in the population in that period. In fact, the decline of this species from the 1960s to the early 1990s was larger than that of any other endemic grassland bird as recorded by the BBS.

Trend analyses from Breeding Bird Surveys up to the present indicate a 2.7% annual survey-wide decline ( $P=0.00006$ ,  $n=48$ ) from 1966 to 2007 (Sauer et al. 2008), although the analysis for the period 1993 – 2007 is actually showing an increase. The surveyed population in Colorado is primarily responsible for this possible increase. However, breeding Mountain Plovers are relatively inconspicuous, easily overlooked, and are poorly sampled by roadside surveys such as the BBS. Such trend estimates should be viewed with considerable caution, as most data for this species are obtained on fewer than 5 routes that have been consistently surveyed since the 1960s.

*Canadian Population Trends.* Mountain Plovers only occur peripherally in Canada. The scarcity of records may indicate that it is not a regular breeder in Canada. The lack of regular nesting immediately across the border in Montana somewhat reinforces that view, although the species does nest commonly about 150 km south of the border, thus plovers can be expected to wander north on a regular basis. Figure 3 shows the occurrences and nest records in Canada from 1939 to present, showing the increase in records during the last 30 years. However, the Canadian records likely include a bias, of unknown strength, of increased search effort in later years.

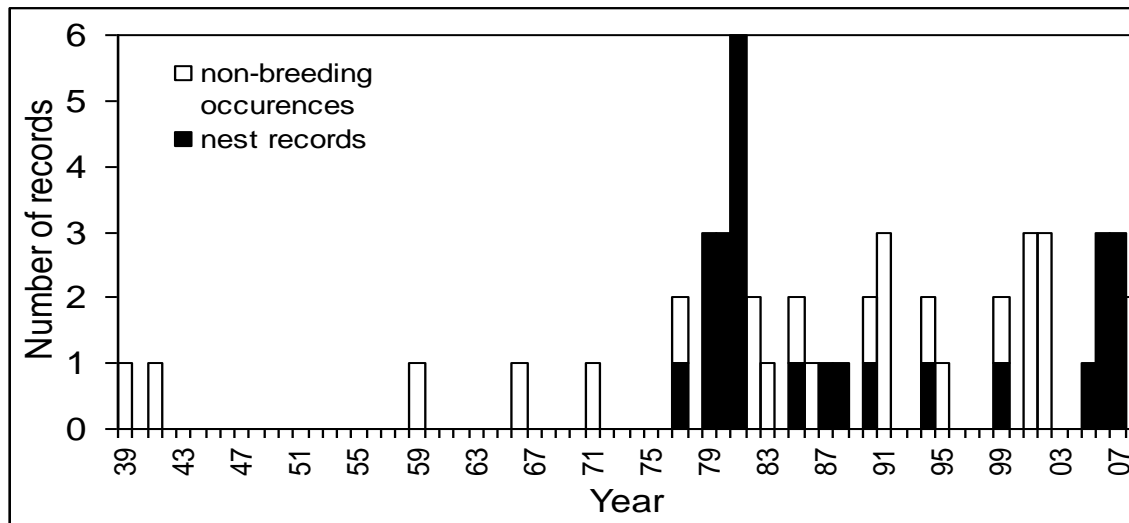


Figure 3. Number of occurrences and nest records in Canada 1939 – 2007

### Local Ecological Knowledge

Not applicable

### Rescue effect

None of the known major breeding locations for Mountain Plovers in Montana are adjacent to the Canadian border. The Fort Belknap Indian Reservation is located about 120 km southeast of Wild Horse, Alberta, and about 80 km south-southwest of Val Marie, Saskatchewan. The largest known number of breeding Mountain Plovers is found on an extensive complex of Black-tailed Prairie Dog colonies in the contiguous Phillips and Blaine Counties (Knowles and Knowles 2001, Dinsmore et al. 2003) 100-200 km south of the border. The large population of Mountain Plovers (Olson and Edge 1985) on the Charles M. Russell National Wildlife Refuge in southern Phillips County lies about 150 km south-southwest of Val Marie and 190 km southeast of Wild Horse. The occupied habitat dominated by Nuttall sagebrush (*Atriplex nuttallii*) southwest of Glasgow along Little Beaver Creek in Valley County (Faunawest 1991) lies about 150 km southeast of Val Marie.

Occasionally isolated breeding pairs have been located in northern Montana, which evidently are not present the following year. Knowles and Knowles (1998) report a pair of Mountain Plovers with three chicks in 1996 in Toole County, about 25 km south of Alberta in the vicinity of the Sweetgrass Hills, 90 km southwest of Onefour, and about 75

km southwest of the Milk River records (see above). The habitat used by the birds was restricted to an intensively cattle-grazed grassland site occupied by Richardson's Ground Squirrels. There was apparently 25 km<sup>2</sup> of similar habitat in the general area, and pockets of similar habitat isolated by agriculture north to the Sweetgrass Hills. However, results of a survey conducted on July 25, 1991, along 100 km of roads between Havre and the Alberta border revealed no plovers and "over 90% of the survey area had been disturbed by agriculture" (Knowles and Knowles 1998). Other surveys conducted in the 1990s close to the Canadian border in Montana failed to find plovers along the Milk River northwest of Havre and south of the Sweetgrass Hills west to Kevin (Knowles and Knowles 1998).

Global climate change has been implicated in what appears to be a subtle northward shift in distribution of the Mountain Plover (Peterson 2002) although sample sizes are too small to be definitive. However, should such a shift occur, then further occurrences in Canada might be more frequent

## **LIMITING FACTORS AND THREATS**

The Mountain Plover is an intensively studied endemic species of the Great Plains. The proposal to list it as a Threatened Species under the auspices of the Endangered Species Act (U.S. Fish and Wildlife Service 2002) identified five major threats to the continental population: (1) conversion of native grasslands to agriculture on the breeding grounds, (2) destruction of nests by certain agricultural practices, (3) historic conversion of native grasslands on wintering grounds, (4) consequences of rangeland management (standardized grazing, reduction of prairie-dog populations), and (5) conflicts arising from the development of mineral extraction projects. These threats, individually and cumulatively, influence populations of other Great Plain endemics also.

### **Hunting**

Early declines were probably related to "market" hunting (Leachman and Osmundson 1990, BirdLife International March 2008). Before 1900 the Mountain Plover was an abundant and important gamebird (del Hoyo et al. 1996). Populations suffered greatly in the 1800s and early 1900s due to the uncontrolled trade in market hunting (Wershler and Wallis 1987). The species being both approachable and having a tendency to flock was an easy target (Knopf 1996). Contemporary shooting, if any, is neither documented nor probably a current conservation concern. However, even after hunting was abolished, Mountain Plover numbers continued to fall (Dinsmore 2003).

### **Habitat destruction**

The recent decline in the continental population of Mountain Plover is attributed to the conversion of native grassland to cropland, agricultural practices and the management of domestic livestock. The continued loss and alteration of habitat on their breeding and wintering grounds is the primary threat to the Mountain Plover.

Changing agricultural practices on breeding grounds have contributed to the decline of this species in recent decades. Conversion of short-grass prairie to agricultural land, primarily for winter wheat, has destroyed nesting habitat, as has

planting of taller grasses in native prairie (Knopf 1996). Wintering areas in California are under extreme pressure from the conversion of cultivated fields to vineyards, orchards, and urban development, the loss of grasslands, and potentially environmental contaminants (Leachman and Osmundson 1990; Knopf 1996; Knopf and Rupert 1995).

The species decline in the last 30 years has been relatively universal across all of its breeding range (Knopf and Rupert 1995), with the main culprit being the destruction of its native grassland habitat (Shackford et al. 1998). Most of the plover's former habitat in Montana is now intensively cultivated as is a large proportion of the land in southwest Saskatchewan ploughed under for agricultural purposes (Wershler and Wallis 1987). These practices have dramatically altered the Mountain Plovers habitat, with as much as 45% of the naturally occurring blue grama and buffalo grass being destroyed (Wershler and Wallis 1987). The growth of taller vegetation poses a threat to the birds' survival, as the birds rely on all-round visibility to detect predators (Knopf 1996). Range modification has included planting invasive exotic species, such as crested wheatgrass (*Agropyron cristatum*) (Wershler and Wallis 1987). Wintering grounds have been affected, with virtually all alkaline flats, the birds preferred habitat, having been manipulated to leach salts from the soil, therefore facilitating the conversion to cropland (Knopf and Rupert. 1995).

Advances in irrigation have resulted in additional ploughing of short-grass prairie previously unsuitable for agriculture. Ploughed prairies that have been allowed to revert to grassland are usually revegetated with taller vegetation unsuitable for the plovers. Improved range management practices on existing grasslands also have had an effect. Most pastures are managed to promote the growth of taller grasses through techniques such as rotational grazing, temporary cutbacks in grazing, and improving soil moisture. Ironically, those range improvement practices create areas avoided by the Mountain Plover, a "disturbance-evolved" species.

In Canada, the major threat has been reported as range management practices which discourage heavily grazed grassland and thereby restrict suitable breeding habitat. The resulting occasional isolated breeding pairs are therefore vulnerable to natural events such as weather extremes and predation (Wershler 2000). Extent of habitat, as well as type, is also an important prerequisite for breeding sites, with nests even in the densest populations in Colorado being far apart (Wershler and Wallis 1987).

### **Use of Cultivated Land**

As noted above, Mountain Plovers are not known to use cultivated land in Montana, and likely the same situation occurs in Alberta and Saskatchewan. In areas in the southern part of the species' breeding range, a loss of 70% of nests on cultivated land destroyed by farm machinery has been reported (Knopf and Wunder 2006). In such areas where grassland habitat is no longer available, Mountain Plovers may breed in fallow or recently planted fields. For some crops, such as millet and sunflower seed, planting may occur after Mountain Plovers have nested in open fields. Nests may subsequently be destroyed by farm equipment or abandoned by the parents once crops grow to a height that impairs their ability to spot predators.

### **Decline of native herbivores**

The decline of native herbivorous mammals, such as bison and prairie dogs, has led to detrimental changes in the remaining prairie ecosystems, though in some areas cattle have maintained the sparsely vegetated open expanses preferred by Mountain Plovers (Askins 2000, Birdlife International 2008). The bison, a former grazer of the Great Plains, is now functionally extinct and the only primary grazer that remains is the prairie dog, although prairie dogs may have declined by as much as 99 percent to their present day numbers through disease, poisoning and recreational shooting (Dinsmore 2003). In Montana, and likely elsewhere, Mountain Plover populations declined following elimination of the bison, and are still directly related to surface coverage of active Black-tailed Prairie Dog towns (Dinsmore et al. 2005).

Much of the native grassland within the Canadian range of southwestern Saskatchewan and southeastern Alberta, has effectively been reduced and fragmented, owing to cultivation of the area, with the largest remaining tracts occurring around the Lost River and Milk River in Alberta, and the Frenchman River in Saskatchewan (Wershler and Wallis 1987). Although portions of this habitat are protected, much is Crown owned and leased for grazing, and is therefore kept in a uniformly moderately grazed condition, not patchy heavy grazing which is required to maintain suitable nesting habitat (Wershler and Wallis 1987).

### **Burning**

The use of prescribed burning has been recommended to enhance the attractiveness of prairie for Mountain Plovers, both on wintering and breeding grounds (Knopf 1996). Mountain Plovers are strongly attracted to burned grasslands both in spring for nesting and in fall and winter for foraging and night roost sites. Plover response to burns is often quick, with birds appearing on fields where fires are still smoldering. Experimental burning programs initiated by the U.S. Forest Service on the Pawnee National Grassland and the Comanche National Grassland (Knopf and Rupert 1995, Svingen and Giesen 1999, Augustine et al. 2008) have resulted in higher Mountain Plover populations and higher rates of nesting success.

### **Pesticides**

Studies have found organochlorine residues to be present in Mountain Plover specimens, but not at levels (Knopf 1996) presumed to have an effect on the birds' general biology (Knopf 1998). Organochlorine residues in 40 birds collected in 1991–1992 in California, ranged from 1.0 to 10.0 ppm for DDE (high levels for an upland species) and from 0 to 0.36 ppm for DDT (Knopf 1996). No abnormalities in behavior of birds or in eggshell thickness were observed. Eggs collected in 2001 from ten abandoned nests in Park County, Colorado, ranged from 0.11 to 115.00 ppm DDE. In 2005, in Park County, cracked eggs were found in three nests, and another egg cracked when picked up lightly from the nest.

However, more research needs to be undertaken into the potential health consequences of inhaled organophosphates as birds wintering in the Central Valley, California, spend the season within an agrochemically contaminated fog, which when inhaled may affect the birds' cholinesterase activity (Knopf 1996). Charadriiformes are thought to be especially susceptible to this type of contamination, as they have a relatively high number of airsacs (12 pairs) compared to other birds (Knopf 1996).

Thus, in summary, unequivocal information is not yet available on the effects of pesticides on the Mountain Plover.

### **Weather Extremes**

Weather extremes may play a significant role in the occurrence of Mountain Plovers in Canada. Fluctuations in precipitation can have adverse effects on the suitability of nesting habitat. For example, above average precipitation and resulting lush grass cover can render habitat unsuitable for nesting if existing grazing intensity is insufficient to maintain short vegetation and bare ground (Wershler and Wallis 1987, U.S. Fish and Wildlife Service 1999a). At the other extreme, drought conditions have been hypothesized as contributing to low fledging rates by decreasing food supply and simultaneously increasing predation pressures (Knopf 1996). While weather extremes themselves are not considered a threat to the Mountain Plover, the declining population and distribution of this species could make it more vulnerable to these natural events in the future (U.S. Fish and Wildlife Service 1999b).

Most climate change projections for the Prairies show an increase in temperature under global warming. According to the Canadian Global Climate Model, the southern Prairies could experience serious summer deficiencies in soil moisture by the end of this century. However, not all parts of the Prairies will experience the same effects, and at least one prediction is that no major change in drought frequency will occur in southern Alberta (Natural Resources Canada 2007).

### **Predation**

As mentioned earlier, predators on eggs and chicks include various mammals, birds, snakes and insects, but none are likely a limiting factor in Canada.

### **Human Impacts**

**Human Disturbance:** Mountain Plovers may be vulnerable to human and vehicular disturbance during courtship, egg laying and early chick development. However, the species is known to be extremely tolerant of machinery, including off-road vehicles, tractors and military aircraft. An incubating bird quickly leaves the nest site when approached by walking human, and as such eggs are subject to overheating due to solar radiation if disturbance precludes the plover from returning to the nest for prolonged periods, or predation by ravens especially when nests have been marked with flagging by researchers. The major direct human impact is farm equipment destroying nests and eggs when working spring fallow fields (Knopf and Rupert 1999b). Domestic cattle (*Bos taurus*) may step on nests, but such incidents are rare (Miller and Knopf 1993) and likely are incidental compared to historical bison trampling. Nests that are flagged before tillage need only to be missed by a few cm for the bird to continue incubation to hatching of eggs. Mettenbrink et al. (2006) determined that nest success was not attributable to anthropogenic edges such as roads, fence lines and perimeters of crop fields.

**Industrial and Recreational Activity:** Industrial use of an area frequented by Mountain Plovers would increase the possibilities for disturbance, and disturbance by the oil and gas industries is being investigated in parts of its range. An increase in number of visitors to Alberta's remaining grassland to admire its rare flora and fauna in recent years

has resulted in the establishment of more vehicle trails (Wershler and Wallis 1987), which in turn has increased the level of disturbance in the area, rather ironically threatening the species even more.

In the United States, onsite construction for oil and gas exploration, wind-power development, and water well drilling is restricted approximately 1 April to 30 June at key locales in Colorado, Utah and Wyoming, when plovers may be on nests. Finally, random fatalities such as collisions with stationary or moving objects are probably not significant. A Mountain Plover banded as a flightless chick in Montana in June 1965 was recovered in December 1965 at Austin, Texas, presumably struck by an aircraft, and an immature struck a barb-wired fence in Wyoming in 2003 (Knopf and Wunder 2006).

### **Interspecific competition**

Mountain Plover nests have been parasitized by Killdeer (Jojola-Elverum and Giesen 2000). The two species are rarely seen together, with the Killdeer generally using patches of open habitat too small for the Mountain Plover, but as suitable habitat becomes increasingly rare, the overlap between the two could increase, potentially resulting in increased competition for territories and nest sites, hence the increase of nest parasitism.

## **SPECIAL SIGNIFICANCE OF THE SPECIES**

Canada represents the northern edge of the breeding range of the Mountain Plover, and indeed this species may not breed every year within Canada. However, the species holds a certain mystique among Canadian birders such that when breeding individuals are located, on accessible land, then birders from across the country go to great lengths to see the species. It is difficult to attribute a quality of bio-indicator to the species as it occupies heavily grazed, disturbed or burnt prairie within its Canadian range.

## **EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS**

The Mountain Plover is currently designated as Endangered in Canada (COSEWIC 2002a, b). The Mountain Plover is a non-game species, and a migratory bird protected under the *Migratory Birds Convention Act, 1994* and is under the management jurisdiction of the federal government. The Migratory Bird Treaty Act protects the Mountain Plover from unauthorized destruction of birds, nests and eggs. It was listed as endangered under the *Species at Risk Act* (SARA) in June 2003. The Canadian Wildlife Service – Prairie and Northern Region, Environment Canada, has led the development of a recovery strategy, in cooperation and consultation with Saskatchewan Environment, Alberta Sustainable Resource Development, the Parks Canada Agency, and Agriculture and Agri-food Canada (Environment Canada 2006).

Owing to long-term declines, the species was listed in the United States as a Candidate Species (meaning that sufficient data are available to support listing species as Threatened or Endangered) under the U.S. Endangered Species Act in 1993. A draft package to list it as Threatened or Endangered (U.S. Fish and Wildlife Service (FWS) 1999b) was withdrawn in 2003 (U.S. FWS 2003) given new information generated during the proposal period (Knopf 1996, Dinsmore et al. 2003; Plumb et al. 2005b; Wunder and

Knopf 2003). This information showed the plover to be more common on private farmland than was previously thought, and to have an ability to adapt in part to pastureland, cropland, sod farms, and other habitats similar to short-grass prairie. The FWS also stated that Black-tailed Prairie Dog towns, which provide habitat favoured by Mountain Plovers, are more abundant than was originally thought. Conservation programs, such as the flagging of plover nests prior to tilling or planting, and encouraging intensive grazing in plover nesting areas have also apparently helped the species.

It is ranked as a G-2 species by The Nature Conservancy (G-2: " Very rare; usually between five and 20 occurrences in the overall range or with many individuals in fewer occurrences; or because of some factor(s) making it vulnerable to extinction;" Knopf and Reichel 1997). In Alberta, the species is ranked as S1B, Endangered, with "four to six pairs known to breed in Alberta" (Alberta Natural Heritage Information Centre November 2006), which is clearly optimistic at best. In Saskatchewan, the Saskatchewan Conservation Data Centre lists the species as Endangered S1B

In the United States, the Mountain Plover is a species of special interest or concern in Montana, Wyoming, Colorado and Oklahoma, extirpated in North Dakota and South Dakota, on the watch list in Kansas and threatened in Nebraska. The 2008 IUCN Red List Category (as evaluated by BirdLife International) ranks the species as Near Threatened, with the justification that it has a moderately small population with a continual decline as a consequence of habitat loss and degradation resulting from cultivation, urbanization, over-grazing, and changes in native herbivore populations. It was formerly classified as Vulnerable by the IUCN (BirdLife International 2008), however, since it is thought not to be as rare as it was believed, it was downlisted to Near Threatened status in 2008 with a decreasing population trend. The Mountain Plover is still listed as a candidate species for protection under the Endangered Species Act. NatureServe's global conservation ranking is G2 (imperiled; at high risk of extinction due to very restricted range, very few populations (often 20 or fewer) and steep declines).

The Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada recommends the protection or increase of silver sagebrush habitat, which could potentially have a negative impact on the Mountain Plover, which requires short vegetation and bare ground. The draft Recovery Strategies for Burrowing Owl and Black-footed Ferret and Management Plan for Black-tailed Prairie Dog all recommend protection of the prairie dog colonies in and near Grasslands National Park, which could benefit Mountain Plovers.

The species is not listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2006). In the United States, the species is not included on the Federal List of Endangered and Threatened Wildlife and Plants (U.S. Fish & Wildlife Service, 2006). Therefore, it does not benefit from any specific protection in the United States outside of the Migratory Birds Conventions with Canada (1917) and Mexico (1972).

# TECHNICALSUMMARY

## *Charadrius montanus*

Mountain Plover

Pluvier montagnard

Range of Occurrence in Canada: AB, SK

Extent and Area Information	
<ul style="list-style-type: none"> <li>Extent of occurrence (EO)(km<sup>2</sup>) [Milk River Natural Area 10 km<sup>2</sup>, Onewfour 100 km<sup>2</sup> and Wild Horse 50 km<sup>2</sup> in Alberta; Grassland National Park (Prairie Dog towns) 10 km<sup>2</sup> in Saskatchewan ]</li> </ul>	170 km <sup>2</sup>
<ul style="list-style-type: none"> <li>Specify trend in EO</li> </ul>	Unknown or stable. Potential annual habitat changes with different agricultural practices, grazing intensity, catastrophic events (e.g., fire), and climatic events (e.g., increased rainfall resulting in lush growth.
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in EO?</li> </ul>	On a large scale, perhaps no; on a fine scale, perhaps yes (as in fire in the Milk River Natural Area)
<ul style="list-style-type: none"> <li>Area of occupancy (AO) (km<sup>2</sup>) [variable from year to year; in 2008, known only from the Milk River Natural Area, and the Heydlauf Ranch; in 2007, only from the Heydlauf Ranch; if present at all four currently known locations (see extent of occurrence above, then a maximum of 20 km<sup>2</sup> - four locations multiplied by 5 km<sup>2</sup>)</li> </ul>	20 km <sup>2</sup> as a maximum
<ul style="list-style-type: none"> <li>Specify trend in AO</li> </ul>	Unknown. Occurrence is not known to be annual, hence the trend is erratic
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in AO?</li> </ul>	yes
<ul style="list-style-type: none"> <li>Number of known or inferred current locations</li> </ul>	Unknown. Maybe 3 - 4
<ul style="list-style-type: none"> <li>Specify trend in #</li> </ul>	Unknown. Erratic, as not present every year; the only locality with a degree of consistency is the Wild Horse location
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in number of locations?</li> </ul>	Yes, if 0 to 4 is extreme
<ul style="list-style-type: none"> <li>Specify trend in area, extent or quality of habitat</li> </ul>	Relatively stable
Population Information	
<ul style="list-style-type: none"> <li>Generation time (average age of parents in the population)</li> </ul>	Unknown. Likely 2 – 3 years

• <i>Number of mature individuals</i>	0 – 11. Maximum 11 in one year; usually fewer than 6
• <i>Total population trend:</i>	Indeterminate, as not present every year
• <i>% decline over the last/next 10 years or 3 generations.</i>	Not applicable, as not present every year
• <i>Are there extreme fluctuations in number of mature individuals?</i>	Yes
• <i>Is the total population severely fragmented?</i>	Yes. Breeding areas are isolated, and interchange among them is unknown
• <i>Specify trend in number of populations</i>	Ranges from 0 to 2 in any one year
• <i>Are there extreme fluctuations in number of populations?</i>	Yes, if 0 to 2 ranks as extreme
• List populations with number of mature individuals in each: • Onefour 0 to 11 individuals • Wild Horse 0 to 4 (possibly more) individuals • Grasslands National Park 0 – 2 • Milk River Natural Area 0 - 2	
•	

#### **Threats (actual or imminent threats to populations or habitats)**

**Habitat destruction** Continuing conversion of native grassland/short-grass prairie to cropland, agricultural practices and the management of domestic livestock.

**Decline of native herbivores** High grazing intensity of native herbivores (e.g., bison and prairie dogs) necessary to maintain suitable habitat. Possibly duplicated by cattle overgrazing.

**Human Impacts** Vulnerable to human and vehicular disturbance during courtship, egg laying and early chick development. Possible disturbance of Mountain Plovers by the oil and gas industries on native prairie

**Pesticides** Information not yet available on the effects of pesticides

**Weather Extremes** Random weather events possibly significant; e.g., above average precipitation and resulting lush grass cover can render habitat unsuitable for nesting

**Predation** In Canada, the Swift Fox may pose a major predation threat in Grasslands National Park and at Onefour.

#### **Rescue Effect (immigration from an outside source)**

<ul style="list-style-type: none"> <li>• <i>Status of outside population(s)?</i>  <b>USA:</b>  [Nearest populations are 100 – 200 km south of the border in southern Phillips County, Montana. Near-threatened in the United States, with an ongoing population decline.]</li> </ul>	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Yes
• <i>Is rescue from outside populations likely?</i>	Yes
<b>Quantitative Analysis</b> [provide details on calculation, source(s) of data, models, etc]	None

<b>Current Status</b>  COSEWIC: Endangered
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Author of Technical Summary: Richard Knapton and Geoffrey Holroyd; October 2008

### Recommended Status and Reasons for Designation

[This table is to be completed in the Interim Report by the SSC;  
COSEWIC will approve or modify the text in this section for the Final Report]

<b>Recommended Status:</b>	<b>Alpha-numeric code:</b>
<b>Reasons for Designation:</b> [Note especially if it is a Canadian endemic with 100% of its distribution in Canada]	
<u><b>Applicability of Criteria</b></u>  <b>Criterion A</b> (Declining Total Population):  <b>Criterion B</b> (Small Distribution, and Decline or Fluctuation):  <b>Criterion C</b> (Small Total Population Size and Decline):  <b>Criterion D</b> (Very Small Population or Restricted Distribution):  <b>Criterion E</b> (Quantitative Analysis):	

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Geoff Holroyd is a research scientist with the Canadian Wildlife Service, an adjunct professor in the Department of Renewable Resources, University of Alberta, and chairman of the Peregrine Falcon Recovery Team. He earned his B.A. in Biology at the University of Western Ontario, and MSc and PhD from the University of Toronto for his studies of the foraging strategies and diet of swallows. He supervised Ecological Wildlife Inventories of Banff, Jasper, Kootenay, Glacier and Mt Revelstoke National Parks, was Section Head of the Threatened Wildlife Section of the Canadian Wildlife Service, has been on several prairie recovery teams and has been president of several non-profit groups including Long Point Bird Observatory, Bow Valley Naturalists, Edmonton Natural History Club and Beaverhill Bird Observatory. He has studied wildlife in many parts of Canada and overseas including bats in South Africa, Blue Swallows in Malawi, owls in Mexico, Spain and Ecuador, and songbirds in Guatemala. He authored and coauthored over 100 articles, booklets and one book. He has received several awards from local, provincial and national groups for his conservation efforts.

## **APPENDIX 1**

### **Elliot Coues and the occurrence of Mountain Plovers in Canada**

Coues (1874) noted that Mountain Plovers were common breeders on the plains north of the Milk River, and that the species favoured nesting on prairie dog towns, stating that “the bird nests anywhere on the dry prairie; but if it have any preference, it is for the stretches of low loose grassy ground where the prairie dogs settle” (Coues 1874:600). The following is taken from the *Northern Boundary Commission, 1873-1874 Report* (Coues 1878). “The Northern Boundary Commission survey charted the United States/Canadian border from the Red River in North Dakota to the Continental Divide in Montana. Ornithologist Dr. Elliot Coues was surgeon/naturalist for the U.S. expedition both years. In 1873, Coues confined his work to the 49th parallel between the Red and Souris Rivers in North Dakota. The following year he left from Fort Buford, at the mouth of the Yellowstone River, and traveled northwesterly towards the 49th parallel, at Frenchman River around early July 1874 (Coues 1878). The remainder of the summer he collected and observed wildlife as he traveled west along the 49th parallel up to Waterton Lake, at which point he turned southeast to Fort Benton, and then down the Missouri River.”

Coues (1878 p. 635) writes ... “The occurrence of this bird in the Milk River Country, along the parallel of 49 N, where it (Mountain Plover) was breeding in considerable numbers .... the northernmost points at which the species has thus far been observed ... it was first seen July 1 (where the Milk River joins the Missouri), and it was traced thence across the country nearly to the Sweetgrass Hills, beyond which it was lost. Its centre of abundance in this region was the vicinity of the Frenchman’s River, where many specimens, both adult and young, together with a set of three eggs, were secured during the first and second weeks of July.” According to Coues’ diary, he reached the Frenchman River at the 49th parallel on July 4, 1874. Coues’ journey in 1874 to the 49th parallel from Fort Buford most likely did not take him straight northwest, but rather took him west to the junction of the Milk and Missouri Rivers, arriving there on July 1, and then northwest up the Milk River. Such a route would take him through present day Valley County close to Phillips County, Montana, and hence through an area in which Mountain Plovers still occur today.

All 16 specimens listed by Coues were collected in Montana (Coues 1878, page 636). The locations are listed as: "Near mouth of Milk River, Mont." on July 1; "Frenchman's River, Mont." on July 4; "Near Frenchman's River, Mont. on July 9; "Near Two Forks of Milk River" on July 13, Two Forks of Milk River on July 16, "Crossing of Milk River, Mont." on July 23. These records indicate that he was in fact not right on the border, and place him some distance south of the actual border; for example, the mouth of Milk River is 100 km from border, the mouth of Frenchman River is 55 km from border, Two Forks is near Malta about 50 km from the border. The Canadian team had a biologist-geologist, George Mercer Dawson surveying the biological resources on the Canadian side of the border. Unfortunately Dawson (1875) does not refer to any birds that he saw during his expedition.